

Remarks

Claims 1-29 are pending in the application. All claims stand rejected. By this paper, claim 1 has been amended. New claims 30 and 31 have been added to provide claim coverage commensurate with the scope of the invention. Reconsideration of all pending claims herein is respectfully requested.

Claims 1, 8, 12, and 29 were rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,269,078 to Lakshman et al. ("Lakshman"). Claims 2-7, 9-11, 13-17, and 27-28 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshman in view of Ito et al. ("Ito"). Claims 18, 21-22, and 26 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshman in view of Humpleman. Claims 19-20 and 23-25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lakshman et al. in view of Humpleman and further in view of Ito. These rejections are respectfully traversed.

The pending application allows a media server to anticipate a future bitrate spike in a previously-encoded multimedia program to be sent to a receiving node, and to proactively adjust the bandwidth allocated to the receiving node to handle the spike without interruption. By retrieving a previously-generated bitrate histogram for the previously-encoded multimedia program, the server is aware of the spike well before it occurs, and may take steps to prevent a buffer underrun, such as by providing additional bandwidth to fill the receiving node's buffer.

Lakshman relates to an entirely different "adaptive" encoding process based on bitrate prediction for video to be encoded in the future. The encoder predicts (501) the need for rate allocation for future frames and provides (502) the predicated

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rate to a network. The network allocates (504) bandwidth in response to the request and advises (504) the source of an explicit rate based on the actual available bandwidth. The encoder at the source then adjusts (505) the current rate based on the advised explicit rate. See FIG. 5.

By contrast, the claimed invention does not predict the bitrate. It conclusively knows the required bitrate at any point during the transmission based on the previously-generated bitrate histogram for the previously-encoded multimedia program. Moreover, the claimed invention does not adjust the encoding rate based on feedback from the network. Indeed, the content has already been encoded and does not need to be re-encoded. (Note that while claim 1 has been amended to explicitly recite that the media program was "previously encoded," this limitation was already included in independent claims 8, 18, 27, and 29).

Lakshman needs to predict the bitrate and adjust the encoding because Lakshman relates to video that has not yet been encoded, such as in a video conference. Col. 9, lines 64-67. Lakshman uses a "mechanism for predicting demands to be made of the network based on the *character* of the video information *which is to be encoded in the future.*" Col. 5, lines 2-4 (emphasis added). The encoder cannot know in advance what the bitrate will be at any given time, since the video has not yet been captured, let alone encoded. Accordingly, it can only look at the character or type of video to be sent, making the goals and overall mechanism employed by Lakshman completely different from that of the claimed invention.

Turning to the claim recitations, claim 1 recites identifying a previously-generated histogram of bitrate as a function of time associated with previously-

encoded multimedia program. Fig. 6A of Lakshman illustrates a histogram of the frequency of B frames in a studied sequence. "B frames are shown because they are the most frequently occurring frames in the studied sequence." Column 9, lines 48-50. Fig. 6A is not a bitrate histogram. A bitrate histogram illustrates a bitrate, i.e. kBits/sec, over a period of time. This is supported by Figures 9a and 9e-m and accompanying text. Lakshman discloses frequency of B frames versus cells per frame and not a bitrate over time. Fig. 6A purposefully omits I and P frames so that a bitrate for the studied sequence is impossible to calculate. Determining the bitrate requires substantially more data, which is not presented in the graph of Fig. 6A. Fig. 6A discloses the frequency of B frames which is relevant for the discussion of correlation that follows. Fig. 6A cannot reasonably be interpreted as a bitrate histogram for a multimedia content.

Furthermore, the graph of FIG. 6A cannot be a histogram of bitrate as a function of time, which could be used to anticipate upcoming bitrate spikes, because there is not time axis. For example, the graph shows approximately 1000 occurrences of 100 cells per frame, with a much smaller number of occurrences of 250-300 cells per frame. However, this graph tells nothing about the temporal position within the media program at which the 250-300 cells per frame occur. The graph cannot be used to anticipate bitrate spikes.

Lakshman does not disclose or suggest a histogram of bitrate as a function of time "associated with a previously-encoded media program to be transmitted to a multimedia node." Lakshman's histogram in FIG. 6A is a histogram of cell rates for a particular type of multimedia content (e.g., video conferencing), not a particular media

program to be sent to a receiving node, as claimed. In other words, FIG. 6A is used to model the characteristics of a type of multimedia content, not to map a specific media program's content. As explained by Lakshman, "[h]aving considered the active and inactive sources and their characteristics, it is possible to thus model and predict what the cell rate needs will be for the encoder based on the types of video to be transmitted." Lakshman simply does not disclose or suggest a previously-generated bitrate histogram for the media program to be transmitted. It is a generic histogram of cell rates vs. frequency for categories of multimedia.

Claim 1 further recites changing a bandwidth allocation for the multimedia node in anticipation of a future bitrate spike indicated in the bitrate histogram. Fig. 6A is "helpful for understanding the prediction of demand rates in accordance with the present invention." Column 4, lines 41-43. However, Fig. 6A does not indicated a bitrate spike. Laksham discloses the prediction or forecasting of rates and does not rely on a bitrate histogram to indicate a known spike. "In an embodiment of the present invention the encoder *predicts* needed rates over very short intervals and requests a rate of the network using a resource management cell provided in the ABR service scheme." Column 3, lines 59-62 (emphasis added).

With respect to Figs. 6A and 6B, Laksham states that:

Also from the plot of auto-correlation it is clear that the short-term correlations are very high – a fact to be exploited in *forecasting*. The *forecasting* can be done using the source model developed in the Heyman article.

Column 9, lines 58-61 (emphasis added). Laksham relies on forecasting and prediction that are done by models. "In connection with describing a technique for *predicting* the needs of the source in terms of bandwidth allocation, the inventors

have focused on models which characterize the video input in terms of the number of cells per frame of video." Column 7, lines 31-35 (emphasis added). Laksham then proceeds to disclose various models for predicting cell rate needs including the Discrete Auto-regressive model (column 8, lines 6-38), the Gamma-Beta Autoregressive model (column 8, line 39 to column 9, line 29), and the Active Source Model (column 9, line 30 to column 10, line 16), as well as "Source Models of Broadcast-Video Traffic", Heyman et al (column 8, lines 26-28 and column 9, lines 60-61). All of these models and the entire disclosure of Laksham relates to predicting demands. Laksham has no teaching or suggestion of relying on the histogram of 6A, or any other histogram, that indicates a bitrate spike. Laksham relies entirely on forecast models rather than a histogram that tracks a previously-generated bitrate.

In the pending application, a media server proactively adjusts the bandwidth allocated in anticipation of a future bitrate spike. By anticipating upcoming bandwidth spikes using the bandwidth histogram, a system may take proactive measures to increase bandwidth to a particular multimedia node to ensure that the node's buffer is full when the spike arrives. Laksham has no such teaching or suggestion. Accordingly, Laksham does not change a bandwidth allocation in anticipation of a future bitrate spike indicated in a bitrate histogram. Rather, Laksham *predicts* demands to a network and calculates allocation rates based on *predicted* demands. Column 15, lines 65-67. Laksham does not use or suggest the use of a bitrate spike or a bitrate histogram in any of its prediction modeling.

The addition of Ito does not cure the deficiencies of Lakshman. Ito does not disclose bitrate histograms. Rather, Ito's video data index includes instructions for

how to extract certain frames of video data to achieve one of several different bitrates depending on the network load. In other words, if the network load won't permit the transmission full 1.5 Mbps video data, Ito's server degrades the video quality, as instructed in the video data index, by selecting some frames and dropping others.

The addition of Humpleman does not cure the deficiencies of Ito and Lakshman. Humpleman merely discloses a home network system that provides browser-based command and control. Nothing in Humpleman suggests the claimed bitrate histogram. Furthermore, nothing in Humpleman suggests modifying a bandwidth allocation in anticipation of a bitrate spike indicated within a bitrate histogram.

Because the cited references fail to disclose the limitations of claim 1, they cannot anticipate claim 1. Anticipation under section 102 is proper only if the reference shows exactly what is claimed. Titanium Metals Corp. v. Banner, 778 F.2d 775, 780, 227 USPQ 773, 777 (Fed. Cir. 1985); MPEP § 2131.01. The applicant respectfully submits that claim 1 is patentably distinct over the cited references. Claims 2-7 depend directly or indirectly from claim 1 and are thus believed to be patentably distinct for at least the same reasons.

Accordingly, the applicant respectfully submits that claim 1 is patentably distinct over the cited references. Claims 2-7 depend directly or indirectly from claim 1 and are thus believed to be patentably distinct for at least the same reasons.

Claim 8 recites dynamically adjusting said first amount of bandwidth based on a previously-generated template of bitrate data as a function of time. As explained above, Lakshman does not disclose a template of bitrate as a function of time.

Furthermore, Lakshman does not disclose a previously-generated histogram of bitrate as a function of time associated with a previously-encoded multimedia program.

Claim 12 depends from claim 8 and requires the further step of "dynamically adjusting said first amount of bandwidth based on a histogram of bitrate data indicating changes in bitrate requirements of a multimedia program requested by a second multimedia node." Lakshman does not disclose changing a bandwidth allocation of a first multimedia node based on a bitrate histogram of a second multimedia node. Even if Lakshman's prediction could be construed to be a template of bitrate data with respect to time, which it cannot, Lakshman does not make bandwidth allocation changes based on "bitrate requirements of a multimedia program requested by a second multimedia node."

Accordingly, the applicant respectfully submits that claims 8 and 12 are patentably distinct over Lakshman. Claims 9-17 depend directly or indirectly from claim 8 and are thus believed to be patentably distinct for at least the same reasons. Claims 18-29 include similar limitations to those found in claims 1-17 and are likewise believed to be patentably distinct.

Claim 29 further recites "identifying a second bitrate histogram associated with a second multimedia program to be transmitted to a second multimedia node, the second bitrate histogram indicating a future spike in bandwidth requirements for the second multimedia program" and "throttling back the bandwidth allocated to the first multimedia program just prior to encountering the bandwidth spike associated with the second multimedia program at a time sufficient to fill a buffer of the first

multimedia node." The applicant respectfully submits that none of the cited references disclose throttling back bandwidth of a first multimedia program based on an anticipated spike in the bandwidth requirements of a second multimedia program as indicated by a bitrate histogram for the second multimedia program.

New claim 30 recites a method comprising:

generating a histogram of bitrate as a function of time for an entire media program before a transmission thereof to a multimedia node;

allocating a first amount of network bandwidth for transmitting the media program to the multimedia node, the first amount being a subset of available network bandwidth to the multimedia node;

identifying, during transmission of the multimedia program, an upcoming bitrate spike within the bitrate histogram for the multimedia program, the bitrate spike temporarily requiring more than the available network bandwidth for transmission of the multimedia program;

temporarily increasing the bandwidth allocation for the multimedia node from the first amount to a second amount in anticipation of the future bitrate spike indicated in the bitrate histogram, the temporarily increased bandwidth allocation being sufficient to fill a buffer at the multimedia node to avoid a buffer underrun at the multimedia node during the future bitrate spike.

Unlike the claimed invention, Lakshman does not generate a histogram of bitrate as a function of time for an entire multimedia program before a transmission thereof to a multimedia node. As noted above, Lakshman relates to video that has not yet been encoded, such as in a video conference. Col. 9, lines 64-67. Hence, Lakshman cannot generate a histogram for an *entire* multimedia program before it is transmitted to the multimedia node.

Moreover, Lakshman does not temporarily increase a program's bandwidth allocation in anticipation of the future bitrate spike indicated in a bitrate histogram to fill a buffer at the multimedia node to avoid a buffer underrun during the future bitrate

spike. At best, Lakshman only predicts (501) the need for rate allocation for future frames and provides (502) the predicated rate to a network. The network allocates (504) bandwidth in response to the request and advises (504) the source of an explicit rate based on the actual available bandwidth. The encoder at the source then adjusts (505) the current rate based on the advised explicit rate. The fact that Lakshman's encoder adjusts the encoding rate clearly shows that the media program has not yet been encoded, contrary to the claimed invention.

Also, adjusting the encoder (and thereby reducing quality) where insufficient bandwidth exists to transmit the media program is completely different from the claimed process of temporarily manipulating the bandwidth allocation based on foreknowledge of upcoming bitrate spikes so that the media program is transmitted with perfect quality. In such cases, Lakshman always results in quality loss, whereas the claimed invention preserves quality.

In view of the foregoing, the applicant respectfully submits that claims 1-31, as amended, are patentably distinct over the cited references, alone or in combination. A Notice of Allowance is respectfully requested. If any issues remain after this response, the Examiner is invited to contact the undersigned at the telephone number provided below.

Respectfully submitted,

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